Meeting of the States Parties to the Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction

August 2018

English only

2018 Meeting
Geneva, 4-7 December 2018

Meeting of Experts on Review of developments in the field of science and technology related to the Convention
Geneva, 9-10 August 2018
Item 8 of the provisional agenda
Any other science and technology developments of relevance to the Convention and also to the activities of relevant multilateral organizations such as the World Health Organization (WHO), World Organisation for Animal Health (OIE), Food and Agriculture Organization (FAO), Intergovernmental Panel on Climate Change (IPPC) and Organisation for the Prohibition of Chemical Weapons (OPCW)

Response by the Director-General of the Organisation for the Prohibition of Chemical Weapons on the Report of the Scientific Advisory Board of the on Developments in Science and Technology for the Fourth Special Session of the Conference of the States Parties to Review the Operation of the Chemical Weapons Convention

Note by the Implementation Support Unit*

1. In its final report, the Meeting of States Parties to the Biological Weapons Convention in December 2017 included the following item to be considered by the Meeting of Experts on Review of Developments in the Field of Science and Technology Related to the Convention: "Any other science and technology developments of relevance to the Convention and also to the activities of relevant multilateral organizations such as the WHO, OIE, FAO, IPPC and OPCW".

2. The OPCW has applied to participate in the 2018 Meeting of Experts on Review of Developments in the Field of Science and Technology Related to the Convention and has submitted the attached report (see the annex) dated 1 June 2018 which is reproduced here as submitted, without formal editing and with the original pagination.

* The Arabic, Chinese, French, Russian and Spanish versions of this document are available from the OPCW.

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OPCW

Review Conference

Fourth Session
19 – 30 November 2018

RC-4/DG.2
1 June 2018
Original: ENGLISH

NOTE BY THE DIRECTOR-GENERAL

RESPONSE BY THE DIRECTOR-GENERAL TO THE REPORT OF THE SCIENTIFIC ADVISORY BOARD ON DEVELOPMENTS IN SCIENCE AND TECHNOLOGY FOR THE FOURTH SPECIAL SESSION OF THE CONFERENCE OF THE STATES PARTIES TO REVIEW THE OPERATION OF THE CHEMICAL WEAPONS CONVENTION

INTRODUCTION

1. Following the practice adopted by the First, Second, and Third Special Sessions of the Conference of the States Parties to Review the Operation of the Chemical Weapons Convention (hereinafter "the First Review Conference", "the Second Review Conference", and "the Third Review Conference"),[1] the Director-General has asked the Scientific Advisory Board (SAB) to prepare a report on developments in science and technology that States Parties to the Chemical Weapons Convention (hereinafter "the Convention") may wish to take into account in their review of the operation of the Convention, as provided for in paragraph 22 of Article VIII. That report has been published as RC-4/DG.1 (dated 30 April 2018) and is now available to States Parties.

2. The Director-General encourages States Parties to familiarise themselves with the executive summary[2] and Annex 1 of RC-4/DG.1. With a view to assisting States Parties in their review of the Convention, particularly with regard to any policy changes that might be necessary on the basis of scientific and technological changes, the Director-General provides his own assessment in this Note.

3. The Director-General wishes to express his appreciation to the SAB for the valuable and thoughtful contribution it has made to the preparations for the Fourth Special Session of the Conference of the States Parties to Review the Operation of the Chemical Weapons Convention (hereinafter "the Fourth Review Conference"). The Director-General notes that the Board's report was the result of extensive deliberations that made use of a wide range of inputs from across scientific disciplinary boundaries (paragraphs 4 and 5 of RC-4/DG.1).

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1 RC-1/DG.2, dated 23 April 2003; RC-2/DG.1, dated 28 February 2008 and Corr.1, dated 5 March 2008; and RC-3/DG.2, dated 31 January 2013.

2 A quick reference guide to the specific recommendations of the RC-4/DG.1 executive summary is available at: www.opcw.org/fileadmin/OPCW/SAB/en/SAB_RC4-Executive_Summary_Recommendations_-_web.pdf

4. In RC-4/DG.1, the SAB has organised its findings into an executive summary that reviews "developments that may impact the scope of the implementation of the Convention" (paragraphs 9 to 13) and "developments related to the Technical Secretariat" (paragraphs 14 and 15). The document also contains the Board's recommendations to the Review Conference (paragraphs 16 to 56). Annex 1 of RC-4/DG.1 contains an in-depth analysis of developments in science and technology relevant to the Convention. This Note by the Director-General focuses on the content of the executive summary, and where needed draws upon the substantive analysis by the SAB contained in Annex 1 of RC-4/DG.1.

DEVELOPMENTS THAT MAY IMPACT THE SCOPE OF THE IMPLEMENTATION OF THE CHEMICAL WEAPONS CONVENTION

5. The SAB's report highlights a complex, dynamic, and highly transdisciplinary (convergent) landscape of twenty-first century scientific research and development. The Board describes how advances in chemistry contribute to progress in other scientific fields, and how new advances across chemistry and chemical technologies are likewise enabled by developments originating from sectors outside chemistry. Recognising the difficulties of clearly identifying, predicting, and keeping abreast of developments with an impact on the Convention, the Director-General advises States Parties that ongoing discussions on advances in science and technology must move beyond speculation about the next potential challenge. He notes that ensuring that implementation of the Convention keeps pace with scientific advancements calls for scientific literacy, understanding how and why advancements are moving forward, and seizing opportunities to use scientific change as a means to enhance capabilities to mitigate challenges, both existing and yet to be seen.

DEVELOPMENTS RELATED TO THE TECHNICAL SECRETARIAT

6. Ensuring that the Technical Secretariat (hereinafter "the Secretariat") is able to effectively fulfil its mandate to implement the Convention requires maintenance of its current levels of knowledge and capability, and expansion of its skills to keep pace with change. The areas of scientific and technological advancement that impact the Convention are likewise just as relevant to the skills and training requirements of the Secretariat.

7. The Director-General considers knowledge management, staying abreast of the changing landscape of chemical production technologies, ensuring access to advanced technologies for chemical analysis (including those suited for chemicals beyond the scope of the schedules), and the consideration of technologies that can enable more effective implementation of the verification regime as priority areas for the Secretariat.

THE SCIENTIFIC ADVISORY BOARD'S RECOMMENDATIONS TO THE FOURTH REVIEW CONFERENCE

Advice on advances in science and technology, including developments in chemical production and discovery (paragraphs 16 to 23 and 30 to 33 of RC-4/DG.1)

8. The Director-General shares the SAB's view that technological change should be considered from a practical perspective, focusing on capabilities relevant to the Convention, irrespective of scientific discipline or technology. In this regard, he has requested units within the Secretariat to carefully review RC-4/DG.1 and formulate proposals on how relevant recommendations can be moved forward. These considerations would include ensuring that the Secretariat has adequate training, job functions and staffing, fit-for-purpose equipment, and access to the technical information required to perform its work. The Director-General believes that a well-equipped and well-trained Secretariat (especially in the Verification, International Cooperation and Assistance, and Inspectorate Divisions) is crucial for effective, efficient, and consistent implementation of the Convention and its verification regime.

9. In regard to assisting States Parties in improving their own scientific and technological capabilities, as well as in the sharing of scientific knowledge, the Director-General encourages States Parties to carefully assess their own unique needs and expertise. Understanding these needs allows identification of relevant scientific communities in which discussion could be initiated. The Secretariat could then draw upon the SAB's scientific review and its own engagement with scientific communities to facilitate useful connections.

10. A wide range of examples of the integration of informatics tools and data analysis with physical and chemical measurements can be found throughout Annex 1 of RC-4/DG.1. These tools have been shown to enhance the informational value of chemical analysis results, and to enable greater capability to make actionable decisions. Computational tools, including the use of artificial intelligence for real-time data analysis, will only continue to become more powerful. The Secretariat is already developing analysis tools for declarations, and will continue to adopt informatics-based approaches in which capabilities dictate need. Given the rapid pace of advancement seen with these tools and methods, the Director-General advises that developments be closely monitored and capabilities explored. In this regard, it is the view of the Director-General that those wishing to benefit from the opportunities presented by data analysis tools must actively engage with developers of tools and platforms in order to ensure that the tools that become available meet the needs for intended end users.

11. The Director-General notes the prominence of recommendations from the SAB related to developments in chemical production (paragraphs 16, 19 to 21, and 30 to 33 of RC-4/DG.1). While the SAB has augmented its previous considerations with new information, the Director-General wishes to point out that the Board has maintained its views on the need to monitor and understand advances in production processes, as well as on verification of industrial use of biomediated processes. These recommendations reflect those of the temporary working groups (TWGs) on

verification[3] and on the convergence of chemistry and biology,[4] as well as the SAB's recommendations to the Third Review Conference (RC-3/DG.1), in particular, the view that any process designed for the formation of a chemical substance should be covered by the term "produced by synthesis".

12. The Director-General notes that the discussion of the meaning of "produced by synthesis" within the Industry Cluster has been extensive. The Director-General appreciates input provided by States Parties to these discussions, including those States Parties that participated in the Secretariat's 2016 survey on biomediated processes (S/1534/2017, dated 14 September 2017). He notes, however, that declaration practices continue to vary across States Parties and that not all States Parties have provided views under the survey or presentations to the Industry Cluster.

13. The Director-General notes the SAB's findings that the adoption of biomediated processes has varied across chemical sectors and chemical products. He further calls attention to recommendation 19 of the TWG on the convergence of chemistry and biology, in which the Secretariat was asked to review the technical feasibility of converting a biobased chemical processing facility to produce chemicals of concern. In the view of the Director-General, such a technical feasibility exercise would be difficult to undertake in the absence of consideration of the purpose and production capacity of a facility, and the types of chemicals the facility might be producing.

14. The Director-General credits the global chemical industry for its contributions to economic growth and its development of programmes for self-regulation, such as Responsible Care®. However, he also recognises a need for vigilance in the face of advances that bring change to industrial chemistry. In this regard, the Fourth Review Conference might consider biomediated processes as part of a larger review of the Article VI verification regime. Such a review might explore the utility of risk-based approaches to verification (paragraph 30 of RC-4/DG.1), as well as previous SAB recommendations that have not been taken forward, such as:[5]

(a) exemption of certain other chemical production facilities (OCPFs) from declaration requirements (recommendation 9a of the TWG on Verification);

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3 Verification, Report of the Scientific Advisory Board's Temporary Working Group (SAB/REP/1/15, dated June 2015); https://www.opcw.org/fileadmin/OPCW/SAB/en/Final_Report_of_SAB_TWG_on_Verification_-_as_presented_to_SAB.pdf. A quick reference guide to the recommendations is available at: www.opcw.org/fileadmin/OPCW/SAB/en/VER_Poster_5102015.pdf.

4 Convergence of Chemistry and Biology: Report of the Scientific Advisory Board's Temporary Working Group (SAB/REP/1/14, dated June 2014); www.opcw.org/fileadmin/OPCW/SAB/en/TWG_Scientific_Advisory_Group_Final_Report.pdf. A quick reference guide to the recommendations is available at: www.opcw.org/fileadmin/OPCW/SAB/en/Convergence_of_Chemistry_and_Biology_1-01.pdf

5 The Director-General has previously called the attention of States Parties to recommendations 9 and 10 of the TWG on verification in his response to the report of the Twenty-Second Session of the SAB (EC-80/DG.7, dated 28 August 2015).

(b) review and reassessment of the impact of the product group codes in the OCPF site-selection methodology (recommendation 9b of the TWG on verification); and

(c) revision of verification thresholds for certain OCPFs (recommendation 10 of the TWG on verification; see also paragraph 33 of RC-4/DG.1).

15. The Secretariat will perform its own analysis of recommendations of the SAB from RC-4/DG.1 relevant to Article VI verification. Proposals will be brought forward for discussion within the Industry Cluster.

16. Monitoring technological developments requires active engagement with those driving change and those adopting advances. The Director-General supports increased interaction between technical experts in other international fora, especially scientific advisory bodies of other disarmament and security focused organisations, who face similar challenges in keeping abreast of science and technology.

17. Furthermore, the Director-General supports active engagement with industrial technology developers, and notes that transferable learnings from chemical industry serve as valuable inputs for the training of Secretariat staff (paragraphs 31 and 32 of RC-4/DG.1).

Advice on chemicals (paragraphs 24 to 29 of RC-4/DG.1)

18. Recognising that substantial change has occurred in both the science of chemistry and in the practices of chemical industry since the schedules were finalised in 1993, the Director-General wishes to call States Parties' attention to the SAB's recommendation to review the schedules (paragraph 24 of RC-4/DG.1). This recommendation has particular relevance given the recent technical assistance visit requested by the United Kingdom of Great Britain and Northern Ireland (S/1612/2018, dated 12 April 2018).

19. In reference to any potential proposals to modify the schedules, the Director-General notes that only States Parties may initiate a proposal for changes to the Annexes of the Convention (paragraph 1 of Article XV), and that the SAB would, as necessary, provide advice on any such proposed changes (subparagraph 2(b) of the Terms of Reference of the Scientific Advisory Board, attached as the Annex to C-II/DEC.10/Rev.1, dated 2 December 2004).

20. The Director-General wishes to draw States Parties' attention to the questions posed by the SAB on whether it is technically feasible to accurately monitor Schedule 3 chemicals that are produced in very large quantities (for example, over 100,000 metric tonnes per year). In regard to review of the schedules, this consideration has particular relevance to any proposal that might seek to include a widely used and large production volume industrial chemical in the Annex on Chemicals, and to resource requirements for verification of facilities that produce such chemicals.

21. In regard to Chemical Abstracts Service registry numbers, and isotopically-labelled forms and stereoisomers of scheduled chemicals, the Director-General appreciates the advice that has been provided (originally in SAB-23/WP.1, dated 28 April 2016). He

notes that at least one State Party has incorporated this advice into its guidance on the Convention[6] and encourages others to do likewise.

22. The SAB is of the view that its technical discussion on the potential use of toxic chemicals for law-enforcement purposes, specifically central nervous system (CNS)-acting chemicals,[7] has been exhaustive and it continues to recommend that the Secretariat prepare for verification activities involving these types of chemicals. The SAB Chairperson had presented the compiled outcomes of the Board's deliberations on this topic to States Parties at a side event in the margins of the Twenty-Second Session of the Conference of the States Parties, in 2017.[8] States Parties are encouraged to review this advice to gain insight for further discussion at the Fourth Review Conference.

23. In highlighting the rapidly growing number of new chemicals reported in scientific literature, the SAB has also noted that the broad scope of the provisions of the Convention ensure that new chemicals used for prohibited purposes would be covered under the "general purpose criterion" of Article II. The Director-General notes the importance of this view in regard to preventing the future re-emergence of chemical weapons and the misuse of toxic chemicals. He supports the recommendations of the SAB to develop methods for analysis of CNS-acting and toxic industrial chemicals, which can be pursued in collaboration with the designated laboratories.

24. In regard to enhancing the capabilities of toxin analysis, the Director-General notes that the OPCW Laboratory has conducted two biotoxin exercises and is working collaboratively with other laboratories to improve capabilities and develop methods. The Director-General looks forward to a series of toxin fact sheets as proposed by the SAB; these could be usefully guided by a priority list developed in cooperation with the OPCW Laboratory and its partners.

Advice on technologies for the delivery of toxic chemicals and drugs (paragraph 34 of RC-4/DG.1)

25. The Director-General wishes to call States Parties' attention to the potential threat raised by the SAB in regard to deploying chemical agents through unmanned systems. He regards the monitoring of developments in this area to be of the utmost importance. Furthermore, the Director-General encourages States Parties to share their views on associated risks and approaches for mitigation.

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6 See "Guidance for those producing, processing, consuming, importing or exporting chemicals covered by the Chemical Weapons Convention (CWC)", United Kingdom of Great Britain and Northern Ireland: https://www.gov.uk/guidance/chemical-weapons-convention-guidance (see specific text under "Schedule 1 chemicals – UK licensing regime").

7 This subject had previously been revised under the label of "incapacitating chemical agents"; see RC-3/DG.1, paragraphs 12 and 13.

8 See "Central Nervous System Acting Chemicals – Considerations from the OPCW Scientific Advisory Board"; www.opcw.org/fileadmin/OPCW/SAB/en/SAB_Considerations_on_CNS-Acting_Chemicals_2003-2017.pdf.

Advice on science and technology of relevance to verification (paragraphs 35 to 47 of RC-4/DG.1)

26. The Director-General is of the view that the verification regime and its implementation should evolve in line with scientific and technological change. In this regard, he calls attention to paragraph 6 of Article VIII of the Convention: "[i]n undertaking its verification activities the Organization shall consider measures to make use of advances in science and technology". The SAB has provided a detailed assessment of technologies of relevance to verification in Annex 1 of RC-4/DG.1 (paragraphs 161 to 293). The Director-General encourages States Parties to undertake a thorough review of this information and has also requested the Secretariat to review the findings and bring forward proposals for taking the SAB advice forward.

27. Taking a holistic approach to verification that integrates all relevant information (paragraph 35 of RC-4/DG.1) has been previously considered in recommendations by the SAB through its TWG on verification (recommendation 1 of SAB/REP/1/15). The Director-General concurs with the SAB that such a comprehensive approach would help to ensure that the verification regime remains relevant in the face of future challenges, and that it would increase the completeness of declarations and reduce declaration discrepancies. The Director-General notes that consideration of a holistic approach would require both a thorough review of organisational structure and capability and an assessment of the degree of implementation of the Convention in order to identify and address gaps and needs.

28. In keeping pace with technological change, the Director-General recognises the importance of electronic tools that ensure the integrity and accuracy of information within the Verification Information System, and also allow this information to be retrieved and analysed (paragraph 36 of RC-4/DG.1). The Secretariat will continue to develop and maintain tools to improve data handling and analysis. This includes the streamlining of the workflow for capturing information obtained during inspections, such as updating forms and reports for compatibility with informatics tools. In regard to informatics tools, the Secretariat must ensure that it has appropriately trained staff to develop and support such tools.

29. The Secretariat has increasingly found itself conducting non-routine inspection and verification activities. The Director-General notes that these non-routine missions have placed inspectors in situations with tight time constraints, difficult to access sampling locations, and potential safety and security risks. The Director-General places the highest priority on ensuring safety and security for Secretariat staff in non-routine operating environments, and recognises the value of unmanned and remote sensing and monitoring equipment for such situations (paragraphs 37 and 38 of RC-4/DG.1). Suitable equipment would enable personnel in the field to minimise risk and exposure to hazardous situations and could usefully be included on the list of approved inspection equipment.

30. The Director-General notes that unmanned remote sensing tools are capable of providing much more than chemical measurements. Capabilities that the Secretariat would benefit from include online monitoring, remote and secure transmission of information and products to field environments, the use of sealed visual recording

equipment, tools for verifying chain of custody, and tracking devices for Secretariat staff deployed in high security risk environments. Capabilities for unmanned systems would include aerial imaging for scene assessment and perimeter monitoring, and systems for chemical detection and sampling. The Director-General supports previous recommendations from the SAB to engage innovators (and link into relevant innovation ecosystems) to gain access to new tools that can be field tested (see also the Director-General's response to the SAB on this topic in EC-87/DG.11, dated 25 January 2018).

31. In regard to the use of satellite imagery, the Director-General notes that the Secretariat has been building expertise in this area for mission planning, with approaches informed by lessons learned from its contingency operations. He also recognises that outputs of satellite image analysis can be enhanced with three-dimensional modelling, GIS[9] data fusion, and spectral and thermal imaging capabilities. To use satellite data (as well as other visual imagery) to its full potential, the Secretariat will need to ensure that its staff have access to suitable training and analysis tools. The Secretariat can further augment its capabilities through cooperating with other international organisations and specialist agencies.

32. The Director-General places importance on ensuring that the Secretariat maintains its capability to identify chemicals, whether existing or yet to be discovered, that may pose a risk under the Convention or would allow differentiation of permitted activities from prohibited activities. In this regard, he supports the recommendation of the SAB for continuous additions to the OPCW Central Analytical Database (OCAD) that allow the OPCW to meet its inspection mandates and include a range of chemicals, some of which may be unscheduled. The Director-General appreciates the work of the Validation Group, which continues to receive and validate data for inclusion in the OCAD. Furthermore, the Director-General regards the recent decision to include relevant unscheduled chemicals in the OCAD (EC-86/DEC.10, dated 13 October 2017) as a step forward in advancing the implementation of the SAB's recommendations.

33. Preventing the re-emergence of chemical weapons requires maintenance and strengthening, including through geographical expansion, of the designated laboratory network and its capabilities (paragraph 40 of RC-4/DG.1). The Director-General views the OPCW Laboratory as a valuable component, serving to facilitate proficiency testing and confidence-building exercises, to support contingency operations, and to provide training and guidance on sampling and analysis (paragraph 47 of RC-4/DG.1). Given the importance of the role of the OPCW Laboratory, the Director-General asks States Parties to support its upgrade to a Centre for Chemistry and Technology.[10]

34. Central to the effectiveness of the laboratories, especially for investigations of alleged use, are capabilities to identify toxic chemicals and their associated breakdown and

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9 GIS = geographic information system.

10 For additional information on the Laboratory upgrade project, see S/1512/2017 (dated 10 July 2017), S/1561/2017 (dated 8 December 2017), and S/1564/2017 (dated 22 December 2017) and Corr.1 (dated 3 January 2018).

reaction products with the highest confidence (paragraphs 42 and 43 of RC-4/DG.1). The OPCW Laboratory, in cooperation with the designated laboratories, will continue to develop, improve upon, and conduct exercises on methods for trace analysis, as well as to identify potential new markers of toxic chemical exposure from both biomedical and environmental samples (especially in regard to reaction products of highly reactive chemicals). The Director-General notes that the Secretariat has actively brought forward new tools and methods for sampling and analysis (guided by, inter alia, SAB recommendations), and that it continues to do so, while providing regular updates to the Board.

35. The Director-General views the sharing of data generated from the work of the OPCW amongst the OPCW designated laboratories as a means to facilitate improved method development and cooperation across the network (paragraph 41 of RC-4/DG.1). The establishment of a repository of chemical data and technical information, and a curated collection of reference samples, could usefully support such method development, as well as provide important reference data on synthetic routes and the environmental fate and transport of chemical warfare agents and other toxic chemicals. The Secretariat is exploring the development of such a repository, which could usefully include information obtained from old and abandoned, as well as sea-dumped, chemical weapons (paragraphs 44 and 45 of RC-4/DG.1). Such information is valuable for review in relation to investigations, assistance missions, and retrospective analysis. The Director-General encourages States Parties to consider sharing relevant chemical and technical data in support of such an initiative; the compilation of certain technical information for sharing with States Parties could be an additional benefit of such a repository.

36. The Director-General recognises the value of publishing results that demonstrate proven methods in peer-reviewed scientific literature—a practice that helps to validate the credibility of these methodologies (paragraph 41 of RC-4/DG.1). The Director-General continues to encourage the SAB to publish its work in suitable scientific journals[11] and encourages designated laboratories to consider doing the same when appropriate permissions are granted.[12]

37. Enhancement of capabilities through the use of methods and approaches developed in the field of forensics has been widely recognised as enabling to the work of the Secretariat (paragraph 46 of RC-4/DG.1). The Director-General has tasked the SAB, through its TWG on investigative science and technology, with providing advice and guidance (for an update on the work of this TWG, see SAB-27/WP.1, dated 26 February 2018). The Director-General looks forward to the results of the TWG's deliberations and encourages consideration of how to take its forthcoming advice forward.

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11 See, for example: Advice on chemical weapons sample stability and storage provided by the Scientific Advisory Board of the Organisation for the Prohibition of Chemical Weapons; *Talanta*; 2018, *article in press*, DOI: 10.1016/j.talanta.2018.04.022.

12 For a recent example of such a publication, see Fatal sarin poisoning in Syria 2013: forensic verification within an international laboratory network; H. Jolm, M. J. van der Schans, M. Koller, H. E. T. Spruit, F. Worek, H. Thiermann, D. Noort; *Forensic Toxicology*; 2018, *36(1)*, 61–71. DOI: 10.1007/s11419-017-0376-7.

Advice on assistance and protection (paragraph 48 of RC-4/DG.1)

38. The provision of assistance to States Parties and the effectiveness of the Rapid Response and Assistance Mission rely on well-trained staff and availability of suitable equipment. The Secretariat maintains a watching brief on protective equipment and countermeasures available on the market. The training programmes facilitated by the Assistance and Protection Branch provide access to networks of relevant expertise, as well as training materials that are available to share with States Parties.

Advice on science and technology of relevance to chemical safety and security (paragraphs 49 to 51 of RC-4/DG.1)

39. As concerns about chemical security and the hostile use of chemicals by non-State Actors, including terrorists, continue to rise, States Parties may benefit from the development of technologies and informatics tools that can help to identify and track chemicals, and provide immediate access to critical chemical information. The Director-General encourages States Parties to review paragraphs 320 to 329 of Annex 1 of RC-4/DG.1 for examples and applications. The Secretariat will look to incorporate this advice from the SAB into the materials and training it currently provides in the area of chemical safety and security.

40. As best practices and approaches for operational aspects of chemical security are considered, access to tools and demonstrations of their use are of critical importance. The Director-General views engaging those working in the chemical sciences to participate in research to identify novel ways to prevent toxic chemicals from being acquired and used as chemical weapons, with a view to developing new approaches and in order to raise awareness amongst practitioners on chemical security issues. The Secretariat is reviewing how the existing Article XI programmes can be used to support such engagement, and is considering how it may further engage other organisations and partners in these efforts (paragraphs 50 and 51 of RC-4/DG.1). The Director-General encourages States Parties to consider their individual needs for chemical safety and security. This is necessary in order to allow the Secretariat to identify the most effective route for facilitation of connections to researchers and organisations that may be interested in exploring areas of common interest.

Advice on scientific literacy and science advice (paragraphs 52 to 56 of RC-4/DG.1)

41. Science and technology are fundamental to the effective implementation of the Convention, as well as to efforts to prevent the re-emergence of chemical weapons and the misuse of toxic chemicals. The Director-General has sought to institutionalise scientific literacy and bring scientific and technological dimensions into the decision-making process. This has required access to scientific networks, drawing on insights from technology developers to aid in horizon scanning, visibility and credibility of the Secretariat across broad scientific communities, and active science engagement with delegations of States Parties.

42. Since the Third Review Conference, the Secretariat has sought to strengthen its ability to monitor scientific developments and to provide support to the SAB in keeping abreast of developments. The Fourth Review Conference may wish to acknowledge

the importance of supporting the scientific review process; in this regard, the Director-General wishes to thank all States Parties that have contributed to the SAB trust fund and provided other financial support to the work of the SAB since the Third Review Conference.

43. The Director-General views science monitoring, engagement, and discourse as a living process, requiring active efforts on the part of the Secretariat and the SAB. The Secretariat will continue to engage scientific communities, making use of its own scientific needs, endeavours (including research by the OPCW Laboratory), engagement with its partners (including the International Union of Pure and Applied Chemistry and other national and regional professional chemical societies) and programmes (including those under Article XI) to maintain and build networks. In addition to ensuring that the Secretariat remains informed on scientific and technological change, the Director-General views engagement across technical communities as complementary and beneficial to the OPCW's education and outreach objectives.

44. Recognising that science-policy discourse also requires active efforts to be maintained and augmented, the Secretariat and the SAB will continue to organise briefings and "Science for Diplomats" events[13] to engage States Parties. The Director-General appreciates the support of these initiatives by States Parties, and encourages all States Parties to attend these events and to engage in the discussions.

45. The Fourth Review Conference may wish to express its support for the Secretariat's efforts to effectively engage and draw upon expertise from scientific communities, to engage delegations on scientific topics and advice, and to ensure that the Secretariat is appropriately staffed for these activities.

Other issues

46. The work of the SAB and the breadth of its scientific knowledge provide great benefits to the work of the OPCW. The detailed assessment contained in Annex 1 of RC-4/DG.1 covers a range of topics that expand upon the executive summary and provide additional detailed recommendations. The Director-General encourages States Parties to review Annex 1 and to consider the proposals and recommendations found therein. He looks forward to a productive discussion of the SAB's findings amongst States Parties in the lead-up to, and during, the Fourth Review Conference.

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[13] For further information on Science for Diplomats see www.opcw.org/special-sections/science-technology/science-for-diplomats/